

Application Number 10/573,239  
Amendment dated February 19, 2009  
Response to Office action of November 20, 2008

### Remarks/Arguments

#### Objections to the claims

Applicant has amended claims 3 and 14 in accordance with Examiner's requirement.

#### Claim Rejections – 35 USC 112

Claim 5 stands rejected under 35 USC 112 as failing to comply with the enablement requirement. Applicant has amended claim 1 to recite the collector electrode 'comprising' rather than 'consisting' of a bandgap material, whereby the use of a dielectric, alkali metal oxide or an alkaline earth oxide is enabled.

Claims 1, 3-8, 10-12, 14-19 and 21 are rejected under 35 USC 112 as being indefinite. According to Applicant's amendment of claim 1 described above in reference to claim 5 this rejection is moot. Furthermore, Applicant refers Examiner to the Example brought in the specification where the use of pure (undoped) Ge as the electrode material is described. Pure Ge can be used as the electrode material since 'even at room temperature, Ge has electron concentration in conductive band  $\sim 10^{13} \text{ cm}^{-3}$ , which is sufficient for electrical conductivity for thin layer'. (pg. 7, first paragraph of Example).

Claims 3, 4, 14 and 15 are rejected under 35 USC 112 as being indefinite. Due to the amendment of claim 1 as described above, this rejection is moot.

Claim 12 has been amended to read 'a tunneling range' rather than 'the tunneling range' in accordance with Examiner's requirement.

Claims 18 and 19 have been amended to read 'said gap' rather than 'a gap' in order to make the claims more distinct.

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### **Claims Rejections – 35 USC 102(b)**

#### **Rejections of claims 1-3, 5, 10-14, 16 and 21 under 35 USC 102(b) as being anticipated by COX**

Claims 1, 5, 10-13, 16 and 21 stand rejected under 35 USC 102(b) as being anticipated by Cox (6,064,137).

To anticipate a claim, the prior art reference must teach every aspect of the claim. Furthermore the alleged identical invention must show in as complete detail as is shown in the supposedly anticipated claim.

Cox teaches two electrodes (a cathode or emitter electrode 4 and an anode or collector electrode 6), where the work function of the anode or collector electrode is specified to be of a lesser magnitude than the work function of the cathode or emitter electrode (see section entitled 'Anode work function' beginning in col. 10, line 60).

Cox's invention differs from the current invention wherein the work function of the collector electrode may be less than *or equal to* the work function of the emitter electrode. The work function of the collector electrode being less than the work function of the emitter electrode is shown in Fig. 2 and described in the accompanying text. The work function of the collector electrode being equal to the work function of the emitter electrode is explicitly disclosed in the Example brought in the Specification, where both the emitter and collector electrodes have equal work functions of 1eV (pg. 7, line 9). The current invention is capable of functioning with electrodes of equal work function due to the current invention's unique capability of creating an 'artificial' work function at very small inter-electrode separations. (see pg. 5 line 30 and pg. 6, second paragraph).

Claims 1, 12 and 13 have been amended to explicitly disclose this aspect of the present invention in order to distinguish the current invention over the prior art. No new material is added through these amendments.

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In view of the amendments made to Claims 1, 12 and 13 and the argument above, Applicant believes that claims 1, 12 and 13 are distinguishable over the prior art of Cox. Furthermore, Applicant believes that claims 5, 10, 11, 16 and 21 are distinguishable over the prior art of Cox due to their dependency on claims 1, 12 and 13. Applicant therefore respectfully requests that Examiner withdraw his rejection of claims 1, 5, 10-13, 16 and 21 under 35 USC 102(b).

**Claims Rejections – 35 USC 103(a)**

**Rejection of claims 1, 5, 6, 10-13, 16 and 17 under 35 USC 103 (a) as being unpatentable over BELL**

Claims 1, 5, 6, 10-13, 16 and 17 are rejected under 35 USC 103(a) as being unpatentable over Bell (4,280,074).

Examiner argues that Bell discloses every aspect of the present invention disclosed in these claims, with the exception of the emitter comprising a metal.

Applicant believes that Bell differs significantly from the present invention, such that even if the assumption concerning Bell's emitter electrode was justified, the invention of Bell would not read on the present invention.

Bell discloses an improved collector electrode where the electron affinity or work function of the surface of the collector electrode is lowered to 'a low level near zero' by the presence of a work function lowering activator (ABSTRACT, col. 2 line 12). This increases the efficiency of the collector electrode.

In the current invention the collector electrode has a work function that is less than *or equal to* the work function of the emitter electrode. This cannot be the case in the prior art of Bell where the work function of the collector electrode is almost zero and the emitter electrode, assuming it is a metal in accordance with Examiner's interpretation, must by definition have a higher work function than the collector electrode.

Claims 1, 12 and 13 have been amended to explicitly disclose this aspect of the present invention. No new material as added by these amendments.

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Due to the amendments of claims 1, 12 and 13, Applicant believes that the current invention is not anticipated by Bell, assuming Bell's emitter electrode to be a metal. Furthermore, due to their dependency on claims 1, 12 and 13, Applicant believes that claims 5, 6, 10, 11, 16 and 17 are allowable over the prior art of Bell. Applicant therefore respectfully requests that Examiner withdraw his rejection of claims 1, 5, 6, 10-13, 16 and 17 under 35 USC 103 (a).

**Rejection of claims 7, 8, 18 and 19 under 35 USC 103 (a) as being unpatentable over COX in view of TAVKHELIDZE**

Claims 7, 8, 18 and 19 stand rejected under 35 USC 103 (a) as being unpatentable over Cox in view of Tavkhelidze (6,417,060).

In the arguments above, Applicant has shown that there is a significant difference between the electrodes of Cox and those of the current invention such that Cox does not read on the current invention.

Furthermore, for the sake of completeness, Applicant does not believe that it would be obvious and without requiring undue experimentation to modify Cox in such a way as to yield an inter-electrode separation of the order of 1-100 nm (claims 7 and 18) or 1-10 nm (claims 8 and 19). Cox's preferred embodiment has an inter-electrode separation of 500nm (Col. 9, line 51) and Cox states that an inter-electrode separation of 100 nm is difficult to manufacture (end of col. 11 and beginning of col. 12). This is partly due to the difficulty of manufacturing spacers of such dimensions. This difficulty is not overcome in Tavkhelidze who rather uses a sacrificial layer to maintain electrode separation. Tavkhelidze makes no contribution to solving the problem of manufacturing spacers on a 1-100 nm scale.

Thus Applicant believes that it would not be obvious or trivial to modify Cox's invention in light of Tavkelidze to give an inter-electrode separation on the scale disclosed in claims 7, 8, 18 and 19.

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Claims 7, 8, 18 and 19 stand rejected under 35 USC 103 (a) as being unpatentable over Bell in view of Tavkhelidze (6,417,060).

Applicant has previously shown that the prior art of Bell does not read on the current invention due to a significant difference between the electrodes of Bell and those of the current invention. Applicant therefore believes that the prior art of Bell, even in combination with Tavkhelidze, would not read on the current invention.

**Double Patenting**

Applicant will timely file a terminal disclaimer should claims 1-9 and 11-15 of copending Application No. 11/392,182 be patented before claims 1-20 of the present application.

Applicant respectfully submits that this application, as amended, is in condition for allowance, and such disposition is earnestly solicited. No new material has been added by these amendments. If the Examiner believes that discussing the application the Applicant over the telephone might advance prosecution, Applicant would welcome the opportunity to do so.

Respectfully submitted,

/A.Martsinovsky/

Artemi MARTSINOVSKY  
Inventor